

# Income inequality within urban settings and depressive symptoms among adolescents

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## ABSTRACT

**Background** Although recent evidence has shown that area-level income inequality is related to increased risk for depression among adults, few studies have tested this association among adolescents.

**Methods** We analysed the cross-sectional data from a sample of 1878 adolescents living in 38 neighbourhoods participating in the 2008 Boston Youth Survey. Using multilevel linear regression modelling, we: (1) estimated the association between neighbourhood income inequality and depressive symptoms, (2) tested for cross-level interactions between sex and neighbourhood income inequality and (3) examined neighbourhood social cohesion as a mediator of the relationship between income inequality and depressive symptoms.

**Results** The association between neighbourhood income inequality and depressive symptoms varied significantly by sex, with girls in higher income inequality neighbourhood reporting higher depressive symptom scores, but not boys. Among girls, a unit increase in Gini Z-score was associated with more depressive symptoms ( $\beta=0.38$ , 95% CI 0.28 to 0.47,  $p=0.01$ ) adjusting for nativity, neighbourhood income, social cohesion, crime and social disorder. There was no evidence that the association between income inequality and depressive symptoms was due to neighbourhood-level differences in social cohesion.

**Conclusions** The distribution of incomes within an urban area adversely affects adolescent girls' mental health; future work is needed to understand why, as well as to examine in greater depth the potential consequences of inequality for males, which may have been difficult to detect here.

## INTRODUCTION

Depression among teens is a major public health concern in the USA. Population-based studies have found that 11.7% of adolescents meet diagnostic criteria for a depressive disorder at some point in their lives,<sup>1</sup> with girls twice as likely than boys to experience depression.<sup>2,3</sup> School-based studies have shown that 28.5% of adolescents report experiencing symptoms of depression, such as feeling sad or hopeless in the previous 12 months.<sup>4</sup> Also, in comparison to white students, Hispanic students are more likely to report depressive symptoms, while black students were less likely.<sup>5</sup> Teens from lower socioeconomic status (SES) backgrounds are more likely to experience depression.<sup>6</sup> For example, the population attributable risk (PAR) for income and education on depression was 26% and 40%, respectively in one study.<sup>7</sup> The population health impacts of depression include suicide, which is the second leading cause of death among adolescents

aged 12–17 years in 2010, shortened educational careers, disruption of social networks<sup>2</sup> and increased risk in participation in adverse behaviours such as smoking, alcohol consumption and drug use.<sup>2</sup>

Neighbourhood characteristics—or the social and physical characteristics of the places where teens live and often go to school—have been associated with depression among children and adolescents.<sup>3,8</sup> In particular, neighbourhoods with poor-quality housing, few resources and unsafe conditions have been linked to the risk of depression.<sup>9</sup> Neighbourhood disorder, low social cohesion and lack of safety have also been identified as predictors of adolescent depression.<sup>10–12</sup>

An important feature of the neighbourhood that has not been studied extensively, but may be relevant for understanding the risk for depression is the distribution of incomes in the neighbourhood—or the level of neighbourhood income equality/inequality.<sup>13</sup> Income inequality within society can have negative consequences on health because when the gap widens between the incomes of the poor and the rest of society, feelings of insecurity, shame and misery intensify among those who are left behind.<sup>14</sup> The resulting feelings of shame and failure are likely to be especially pronounced in American society where the majority still believe that it is possible for everyone to achieve the 'American Dream', even though evidence indicates that social mobility in the US is more constrained than in most European countries.<sup>15</sup> Income inequality also erodes social cohesion,<sup>16</sup> which can accentuate the sense of social exclusion and isolation for those left behind. Since a decline in social cohesion can be reflected as an erosion of trust in other members in the community,<sup>16</sup> a potential consequence could be an increase in depressive symptoms.

To date, 11 studies have investigated the role of income inequality on depression among adults, with all but two<sup>17,18</sup> indicating that higher income inequality associates with more depressive symptoms.<sup>19–27</sup> Two studies were longitudinal<sup>19,27</sup> while the rest were either ecological or cross-sectional.<sup>20–26</sup> Overall, there is strong evidence that income inequality exerts a contextual influence on depressive symptoms and major depressive disorder.

However, to our knowledge, no prior studies have examined the association between income inequality and depressive symptoms among adolescents, a sensitive developmental period for the emergence of depression.<sup>28</sup> Of the few adult studies that have analysed individual-level data, only one examined the relationship between

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neighbourhood-level income inequality and depression;<sup>24</sup> instead the vast majority of published studies have focused on US state-level or county-level income inequality. From the point of view of generating stressful social comparisons (and hence feelings of shame and exclusion), income inequality measured at the neighbourhood level may be more relevant for depression risk than income inequality at a larger scale, such as by states. Thus, further research is needed to determine if an association exists between neighbourhood-level income inequality and depression among youth.

The current study addresses these gaps by investigating income inequality measured at the neighbourhood level and in a sample of adolescents. We hypothesised that the youths residing in neighbourhoods with higher income inequality would be at a greater risk for depression compared with those living in neighbourhoods with lower income inequality. Furthermore, we hypothesised that neighbourhood income inequality would have a stronger association with depression among girls than boys, based on previous research showing differential sex effects of area-level socioeconomic characteristics on health.<sup>29 30</sup> Last, we sought to test whether the association between income inequality and depressive symptoms can be explained by neighbourhood-level variation in social cohesion.

## METHODS

Data came from the 2008 *Boston Youth Survey* (BYS), a biennial cross-sectional survey of high school students in grades 9–12 in Boston Public Schools (n=32).<sup>31 32</sup> All 32 public high schools in Boston serving traditional daytime students (ie, not those schools serving adults in evening programmes) were invited and 22 agreed to participate (69%). The final sample of schools was representative of all schools in the Boston area in terms of race/ethnicity of the students, school drop-out rates and other socio-demographic variables.<sup>33</sup>

A unique list of classrooms was obtained from each school, and classrooms stratified by grade were randomly selected for participation in the BYS until 100–120 students were identified per school. All students in randomly selected classrooms were invited to participate.<sup>33</sup> We used passive consent, and the students were free to decline to participate at any time before or during the survey administration. The response rate was 69%, which yielded a sample size of 1878 youths. Since complete data were available for 1246/1878=66.3% students, we used multiple imputation to address missing sociodemographic and behavioural data.<sup>34</sup> Students who did not provide the location of their residence were excluded from the current analysis. As a result, complete sociodemographic and individual-level social cohesion data within the imputed dataset were available for 1614/1878 (85.9%) students. We created five multiple imputed datasets. The covariates used in the imputation models included sex, age, race, nativity, depressive symptoms, social cohesion and neighbourhood factors. Using SAS V.9.4, we then used multilevel regression analyses to fit the model of interest to each of the imputed datasets. Next, we averaged the estimates to obtain estimated associations.<sup>34</sup> Those with missing data were more likely to be male, black and older in age and to have immigrated to the USA within the past 4 years.

## Data collection

The BYS team of investigators developed a survey questionnaire using established scales that demonstrated good reliability and validity to measure behaviours and experiences in the neighbourhood. During the spring of 2008, a paper-and-pencil survey was administered in classrooms by the trained staff. The

Office of Human Research Administration at the Harvard School of Public Health approved all data collection procedures for the BYS.

## Study variables

### Area-level covariates

Students were asked the nearest cross-street of their residence for geocoding to US Census Tracts, resulting in useable residential information for 85.9% of the total sample (n=1614). Key informants from Boston neighbourhoods helped the research team aggregate the 157 Boston Census Tracts (each with a population of approximately 4000) into 38 socially meaningful neighbourhood clusters of tracts.<sup>35</sup> The details of this process are described elsewhere.<sup>33</sup> Neighbourhood-level characteristics that might act as confounders were included in this investigation.

Census tract (CT)-level income inequality was the main exposure of interest, which was measured using the Gini coefficient. The Gini coefficient ranges from 0 (perfect equality, every household in the CT has the exact same income) to 1.0 (perfect inequality, where households in the CT earn a wide range of incomes). The calculation of the Gini coefficient has been provided elsewhere.<sup>36</sup> The Gini coefficient is based on the Lorenz curve, a cumulative frequency curve that compares the distribution of a specific variable with the uniform distribution that represents equality.<sup>36</sup> In this investigation, the Gini coefficient was calculated for each census tract by the Boston Indicators Project (<http://www.bostonindicators.org/>). We standardised the Gini coefficient using the z-transformation.

Economic deprivation, which is a socioeconomic composite score, was created for each of the 38 neighbourhoods using principal components analysis. US Census indicators used for this score included proportion of residents living below the poverty level, proportion of households receiving public assistance and proportion of families with a female head of household (Cronbach  $\alpha=0.84$ ). A higher score was indicative of greater economic deprivation. Tertiles of the neighbourhood economic deprivation were used to categorise economic deprivation into low, moderate and high values.

For each of the 38 neighbourhoods, disorder scores were determined using data collected from the biennial, random-digit dial telephone survey, the Boston Neighbourhood Survey (BNS) to assess neighbourhood disorder, which has been described elsewhere.<sup>33 37</sup> Adult residents ( $\geq 18$  years) were randomly selected from a list-assisted sampling frame, stratified proportional to population size of the 16 large neighbourhoods defined by the Boston Redevelopment Authority, resulting in a sample size of 1710 adults in 2008. Information from the BNS was used to enrich the BYS data with contextual information about neighbourhood-level conditions and social processes perceived by adult residents.<sup>33 37</sup> Neighbourhood disorder is comprised of social (ie, presence or absence of drinking alcohol in public) and physical disorders (ie, abandoned cars). A combined score was created using these two indicators, with higher scores indicating greater neighbourhood disorder. Tertiles were used to categorise neighbourhoods into low, moderate and high neighbourhood disorder.

We also used the BNS to measure neighbourhood social cohesion at the neighbourhood level by adapting a previously used questionnaire with ascertained reliability and validity in adults.<sup>38</sup> Respondents were asked if they strongly agreed, agreed, disagreed or strongly disagreed with the five statements. For example, People in my neighbourhood can be trusted; People in my neighbourhood are willing to help their

neighbours; I live in a neighbourhood where people know and like each other. A combined score was created and a greater score indicated higher social cohesion.

We used data from the Boston Police Department to measure neighbourhood danger in each of the 38 neighbourhoods. Counts of criminal homicide, robbery, aggravated assault, burglary, larceny theft, vehicle theft and arson were matched to the US Census Tracts. The higher the score, the greater the danger was within the neighbourhood. Tertiles were used to categorise danger within the neighbourhood into low, moderate and high.

Individual-level covariates in the study were students' age, nativity (US born, foreign born arrived  $\leq 4$  years and foreign born arrived  $> 4$  years) and race or ethnicity (white, black, Asian, Hispanic and other).

### Assessment of depressive symptoms

Depressive symptoms were measured using a brief adapted version of the modified depression scale (MDS), which has been described elsewhere.<sup>39</sup> Students were asked to report the frequency of five symptoms in the past month: (a) very sad; (b) grouchy or irritable, or in a bad mood; (c) feel hopeless about the future; (d) sleep a lot more or less than usual and (e) have difficulty concentrating on your school work. Response options included: (1) never, (2) rarely, (3) sometimes, (4) often and (5) always. Total scores were calculated by summing items among participants for all five items (range: 5–25). Scores were standardised using the z-transformation to facilitate the interpretation. A prior study using BYS data found the MDS has good psychometrics (Cronbach's  $\alpha=0.79$ ).<sup>39</sup> The adapted MDS also significantly differentiated youth who had engaged in risk behaviour or who had been victimised from those who had not (ORs ranged from 1.07 to 1.31,  $p<0.001$ ).<sup>39</sup>

On top of social cohesion measured at the neighbourhood level, we measured social cohesion at the individual level. We asked students to assess their perception of neighbourhood social cohesion using five statements. These statements included: I live in a neighbourhood where people know and like each other; People in my neighbourhood are willing to help their neighbours; People in my neighbourhood generally get along with each other; People in my neighbourhood generally share the same beliefs about what is right and wrong; People in my neighbourhood can be trusted. Response options included (1) strongly disagree; (2) disagree; (3) agree and (4) strongly agree. The average social cohesion score was 12.0 (SD=2.9) and the range was 5–20. The items showed high internal consistency (Cronbach  $\alpha=0.80$ ). Tertile cut-offs were used to categorise social cohesion into low, moderate and high values.

### Statistical analysis

Since students were nested within neighbourhoods, we used multilevel modelling to investigate the relationship between neighbourhood income inequality and depression, while controlling for individual-level and neighbourhood-level characteristics. Since students were nested within CTs, which were nested within neighbourhoods, a three-level multilevel model was initially considered, that is, linear mixed models with a random effect specified for each CT and each neighbourhood.<sup>40</sup> However, because a negligible amount of variation in depressive symptoms was explained at the CT level (data not shown), we treated income inequality as an individual-level exposure resulting in a two-level model (with neighbourhood as the level 2 unit).

We fitted the following sequence of models to investigate the association between neighbourhood income inequality and

depression. First, we fitted an intercept-only model, which allowed us to calculate the intraclass correlation coefficient (ICC), quantifying the proportion of variance in depressive symptoms explained at the neighbourhood and individual levels. Second, we fitted models adding individual and neighbourhood characteristics (model 1). Third, we added the sex  $\times$  income inequality interaction term to determine if the association between income inequality and depression differed between boys and girls (model 2). Finally, we added students' perceptions of neighbourhood social cohesion to determine if perceptions mediated the relationship between neighbourhood income inequality and depression.<sup>41</sup> Mediation was evaluated using the Baron and Kenny method by testing and comparing results from three different models, among males and females separately: (1) income inequality and depression, (2) income inequality and social cohesion and (3) social cohesion and depression.

### RESULTS

Characteristics of the 1641 students attending public secondary schools in the Boston area are found in table 1. Overall, the sample had more females (54.3%), almost half were black (41.6%), and a majority was born in the USA (69.5%). The average depressive symptom score was 13.6 (SD=4.3; range 5–25). The average depressive symptom score was 14.4

**Table 1** Sociodemographic characteristics of adolescents (n=1614) and neighbourhoods (n=38) participating in the Boston Youth Study

	n	Proportion (%)
Sex		
Male	738	45.7
Female	876	54.3
Race		
Black	672	41.6
White	150	9.3
Asian/South Asian	145	9.0
Hispanic	553	33.0
Other	114	7.1
Nativity		
Foreign born arrived $\leq 4$ years	161	10.0
Foreign born arrived $> 4$ years	331	20.5
US born	1122	69.5
Age (years)		
13 or 14	133	8.2
15	313	19.4
16	433	26.8
17	421	26.1
18	225	13.9
19	77	4.8
	Mean (SD)	Range
Social cohesion	12.2 (2.9)	5–20
Gini coefficient (tract)	0.45	0.33–0.65
<b>Neighbourhood features (n=38)</b>	<b>Mean (SD)</b>	<b>Range</b>
Economic deprivation	0.02 (1.01)	–1.79 to 2.42
Danger	0.01 (1.10)	–1.17 to 3.46
Disorder	2.87 (0.49)	2.06 to 3.98
Proportion black (%)	37.8 (28.1)	1.8 to 92.5
Social cohesion	3.65 (0.49)	2.1–4.0

**Table 2** The relationship between neighbourhood and individual characteristics with depression among adolescents participating in the 2008 BYS

	Model 1		Model 2		Model 3	
	$\beta$	95% CI	$\beta$	95% CI	$\beta$	95% CI
Intercept	-0.37	(-0.65 to -0.09)	-0.39	(-0.66 to -0.11)	-0.19	(-0.50 to 0.12)
Neighbourhood characteristics						
Economic deprivation (ref: low)						
Moderate	-0.13	(-0.27 to 0.01)	-0.13	(-0.27 to 0.01)	-0.13	(-0.27 to 0.00)
High	-0.18	(-0.32 to -0.04)	-0.18	(-0.33 to -0.03)	-0.19	(-0.34 to -0.05)
Danger (ref: low)						
Moderate	0.18	(0.04 to 0.32)	0.18	(0.04 to 0.32)	0.15	(0.01 to 0.30)
High	-0.03	(-0.14 to 0.09)	-0.03	(-0.14 to 0.08)	-0.05	(-0.17 to 0.06)
Disorder (ref: low)						
Moderate	-0.04	(-0.16 to 0.09)	-0.03	(-0.16 to 0.10)	-0.03	(-0.16 to 0.10)
High	-0.09	(-0.28 to 0.11)	-0.08	(-0.28 to 0.12)	-0.08	(-0.28 to 0.12)
Proportion black (ref: low)						
Moderate	0.05	(-0.05 to 0.14)	0.05	(-0.05 to 0.14)	0.04	(-0.06 to 0.13)
High	0.15	(0.01 to 0.29)	0.15	(0.01 to 0.28)	0.14	(0.00 to 0.27)
Social cohesion (ref: low)						
Moderate	0.12	(-0.02 to 0.26)	0.12	(-0.02 to 0.26)	0.13	(0.00 to 0.26)
High	-0.06	(-0.24 to 0.12)	-0.06	(-0.23 to 0.12)	-0.03	(-0.20 to 0.13)
Individual-level characteristics						
Sex						
Male						
Female	0.38	(0.28 to 0.47)	0.39	(0.30 to 0.48)	0.39	(0.30 to 0.47)
Gini (Z-transformed)			-0.03	(-0.11 to 0.05)	-0.03	(-0.11 to 0.05)
Female×Gini			0.11	(0.02 to 0.20)	0.11	(0.01 to 0.20)
Race						
White (ref)						
Black	0.04	(-0.14 to 0.21)	0.04	(-0.13 to 0.22)	0.01	(-0.19 to 0.20)
Asian	0.05	(-0.21 to 0.32)	0.05	(-0.21 to 0.32)	0.04	(-0.23 to 0.31)
Hispanic	0.05	(-0.12 to 0.22)	0.06	(-0.11 to 0.23)	0.01	(-0.17 to 0.19)
Other	0.19	(-0.09 to 0.47)	0.20	(-0.08 to 0.48)	0.16	(-0.13 to 0.45)
Nativity						
US born (ref)						
Foreign born ( $\leq 4$ years)	-0.07	(-0.24 to 0.11)	0.02	(-0.08 to 0.11)	0.01	(-0.09 to 0.11)
Foreign born ( $> 4$ years)	0.01	(-0.08 to 0.11)	-0.06	(-0.24 to 0.13)	-0.08	(-0.25 to 0.10)
Age (years)						
14						
15	0.08	(-0.08 to 0.24)	0.08	(-0.09 to 0.24)	0.07	(-0.10 to 0.24)
16	0.16	(-0.01 to 0.34)	0.16	(-0.02 to 0.34)	0.17	(-0.01 to 0.34)
17	0.10	(-0.05 to 0.25)	0.10	(-0.06 to 0.25)	0.10	(-0.05 to 0.26)
18	0.22	(0.04 to 0.39)	0.21	(0.03 to 0.39)	0.21	(0.03 to 0.39)
19	0.28	(-0.13 to 0.70)	0.28	(-0.14 to 0.69)	0.25	(-0.15 to 0.66)
Social cohesion						
Low (ref)						
Moderate					-0.16	(-0.28 to -0.05)
High					-0.26	(-0.40 to -0.13)

(SD=4.2) among females and 12.8 (SD=4.4) among males. The average Gini score across the census tracts was 0.45 (SD=0.06; range=0.33–0.65). The Gini score of Boston is similar to the overall value for the US, which has a score of 0.47.<sup>42</sup>

A summary of the neighbourhood characteristics can also be found in table 1. The average economic deprivation score was 0.02 (SD=1.01, range=-1.79–2.42). The average proportion of the neighbourhood that was black was 37.8% (SD=28.1, range=1.8–92.5).

The ICC derived from the null model was 0.05, which indicates that 5% of the variance in depressive symptoms was explained by neighbourhood-level characteristics. The results of

models for the relationship between neighbourhood income inequality and depression are presented in table 2. In the adjusted model (table 2, model 1), there was no significant relationship between income inequality and depression ( $\beta=0.03$ , 95% CI -0.01 to 0.08). When a sex×income inequality interaction was included, females had significantly higher depression scores ( $\beta=0.39$ , 95% CI 0.30 to 0.48) and a sex×Gini coefficient interaction term was significant ( $\beta=0.11$ , 95% CI 0.02 to 0.20,  $p=0.01$ ) (table 2, model 2). Therefore, girls living in higher Gini-coefficient areas had significantly higher depressive scores than those living in more equal areas. An average depression score for girls from the most equal neighbourhoods is 0.39

while the average score for girls in the most unequal neighbourhoods is 0.50.

Unexpectedly, we found a significant inverse relationship between neighbourhood economic deprivation and depressive symptoms. For example, in comparison to those who lived in the least economically deprived neighbourhoods, those living in moderate ( $\beta = -0.13$ , 95% CI  $-0.27$  to  $0.01$ ) and high economically deprived neighbourhoods ( $\beta = -0.18$ , 95% CI  $-0.33$  to  $-0.03$ ) had lower depressive symptom scores.

When individual-level social cohesion was tested as a possible mediator between income inequality and depression, the risk estimates did not change (table 2, model 3). Therefore, there was no evidence for the involvement of social cohesion in the association between neighbourhood income inequality and depression. This finding was also confirmed with the Baron and Kenny method to test for mediation. Income inequality was associated with a decreased likelihood of reporting high social cohesion among boys only and was not significantly associated with depressive symptoms. Individual-level perceptions of neighbourhood social cohesion were associated with depression among boys and girls. Results of testing possible mediation relationships are shown in table 3. The association between social cohesion and depressive symptoms was mainly due to social cohesion at the individual level since the association between area-level social cohesion and depressive symptoms was somewhat attenuated when individual-level social cohesion was added to the model.

## DISCUSSION

We investigated the association between neighbourhood-level income inequality and depressive symptoms among Boston-area adolescents. Our results suggest that neighbourhood-level income inequality is associated with higher levels of depressive symptoms among adolescent girls but not boys. These findings are consistent with the previous research showing US state-level income inequality predicts an increased odds of experiencing a depressive episode among women and not men.<sup>19</sup>

Income inequality, or the unequal distribution of income in a society, has been theorised to be associated with depression. Several mechanisms have been proposed, which may be adapted

to the residential neighbourhood setting. Neighbourhoods with high levels of income inequality might lead to stressful comparisons and a growing sense of relative deprivation.<sup>43</sup> These invidious social comparisons might intensify feelings of competition, making one's status more important compared with societies with more equitable income distributions.<sup>14</sup> Feelings of anger and frustration might amplify because of lack of access to resources and status.<sup>14</sup> Adolescents might be aware of their status,<sup>44</sup> which might foster a social environment that leads to social isolation and therefore depression.<sup>45</sup>

Another mechanism is that income inequality erodes social cohesion, which could affect all members of a neighbourhood, including individuals from high and low socioeconomic backgrounds. The erosion of social cohesion and trust in turn lead to feelings of fear and insecurity, which are associated with depression.<sup>43</sup> However, our results suggest that student self-reported social cohesion does not explain the association between income inequality and depression.

These results indicate that girls and boys react differently to their residential environment. While girls living in more unequal areas had higher levels of depressive symptoms than their male counterparts, findings from a recently published article indicate that boys living in high inequality neighbourhoods were more likely to be involved in acts of violence as well as to be victims of aggression, in comparison to girls in similar residential neighbourhoods.<sup>46</sup> Thus, boys and girls may react or cope differently with exposure to a highly unequal environment. For example, when income inequality is eroded, stress levels might increase. Females have been shown to cope with stress differently in comparison to males. Generally speaking, boys react to stress through externalising behaviours (acting out, or engaging in aggression), while girls are more likely to internalise their problems (ie, becoming withdrawn and depressed).<sup>47</sup>

These findings should be interpreted in the light of the following limitations. We used cross-sectional data to investigate the relationship between income inequality and depression, and therefore temporality could not be established. Also, since individual-level socioeconomic covariates, such as household income, parental education or occupation were not collected, residual confounding might be an issue. Also, the Baron and Kenny method of mediation assessment might lead to biased results because of unmeasured confounding that may exist between mediator and outcome.<sup>48 49</sup> Furthermore, characteristics of the classroom or school settings that were not available to this study have been shown to be important in shaping the health of adolescents,<sup>50</sup> since these contexts are more proximal to the student, and therefore more likely to be more influential on the health of the individual. Taking into account school, classroom and neighbourhood factors in a cross-classified analysis would be helpful in disentangling the relationship between contextual income inequality and depression. Finally, generalisability is a limitation; while we might be able to generalise the results to urban centres that have similar distributions of income and population sizes to Boston, results may not be applicable to other populations.

In conclusion, findings from this study suggest that income inequality is associated with depressive symptoms among adolescent girls living in an urban setting. Income inequality is potentially harmful to the development and mental health of adolescents living within a residential neighbourhood with high income inequality. Further investigation should include longitudinal analysis to determine whether neighbourhood income inequality is a determinant of depression among adolescents

**Table 3** Bivariate analysis of the relationships between social cohesion, as a potential mediator, and income inequality and depression among boys and girls: 2008 Boston Youth Survey

	High social cohesion OR (95% CI)	Depression Z-score $\beta$ (95% CI)
<i>Boys</i>		
Income inequality		
Gini Z-score	0.79 (0.65 to 0.96)	-0.06 (-0.15 to 0.02)
Social cohesion score (ref: low)		
Moderate		-0.10 (-0.27 to 0.06)
High		-0.22 (-0.38 to -0.07)
<i>Girls</i>		
Income inequality (ref: Gini <75th centile)		
Gini Z-score	0.89 (0.76 to 1.06)	0.04 (-0.03 to 0.12)
Social cohesion score (ref: low/moderate)		
Moderate		-0.22 (-0.36 to -0.07)
High		-0.27 (-0.41 to -0.13)

and to identify potential mediators that can explain this association and for the sex differences observed.

What is already known on this subject

- ▶ Contextual income inequality has shown to be related to depressive symptoms among women.
- ▶ However, most studies that have investigated the relationship between contextual income inequality have been conducted among adults and have not looked at income inequality within neighbourhoods.

What this study adds

Neighbourhood income inequality is associated with depressive symptoms among adolescent girls but not boys.

**Contributors** RP developed the research question and conceptual model, conducted the main analyses, and was the lead author. ECD evaluated the psychometric properties of the modified depression scale and helped write the manuscript. EG contributed to the development of the conceptual framework, interpretation of the results and critical revision of the manuscript. IK provided theoretical support and assisted with the writing of the paper. BEM helped develop the research question, provided assistance with the writing of the manuscript and provided guidance throughout the whole manuscript process.

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**Data sharing statement** Data from the Boston Data Project are instrumental in evaluation, as we are able to track trends in knowledge, attitude, and/or behaviour before and after policies or programmes are enacted. For more information on the Boston Data Project, please contact Deb Azrael, Director of Research, at (617) 432-0473.

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